THE *Cane Growers'* QUARTERLY BULLETIN

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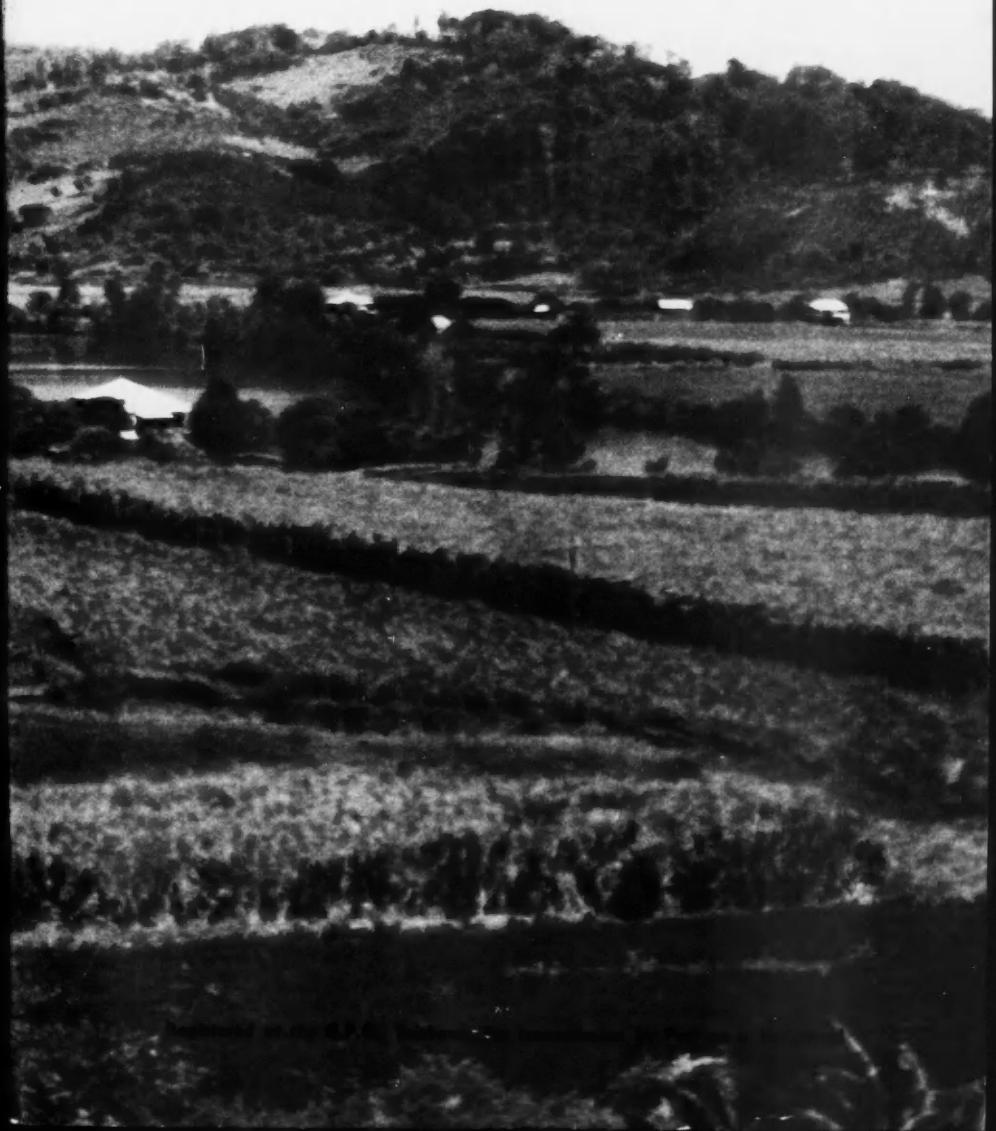

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BUREAU OF SUGAR EXPERIMENT STATIONS
BRISBANE

THE CANE GROWERS' QUARTERLY BULLETIN

ISSUED BY DIRECTION OF THE
SUGAR EXPERIMENT STATIONS
BOARD

1 OCTOBER, 1955

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This Bulletin is an official publication of the extension service of the Bureau of Sugar Experiment Stations, issued and forwarded by the Bureau to all cane growers in Queensland.

The

Cane Growers' Quarterly Bulletin

VOL. XIX. 1 OCTOBER, 1955 No. 2

Weed Control in Irrigation Channels

By I. T. Freshwater and R. B. Moller

The control of grass and weed growth in open irrigation drains is an annual problem confronting most growers in the Burdekin area. Undoubtedly, the answer to the problem is to replace most existing open drains with concrete pipes. Although the initial outlay is much greater with concrete piping, maintenance costs are greatly reduced and the efficiency of the irrigation system is increased through reduced water losses.

After the wet season, grass growth is heavy and vigorous, and the drains must be either chipped or scythed. After the heavy growth has been removed many farmers make use of the creosote-based contact weedicides, kerosene and diesel oil. These materials control young grass growth but they do not kill established grass tufts. Their use and value, therefore, is very limited.

From time to time new chemicals are made available in small quantities and these are tried out on existing drains under normal field conditions. During the past year tests have been carried out with AK100, Polybor-chlorate and Borascu.

AK100.

This chemical is considered to be synonymous with C.M.U., which is highly regarded overseas, and particularly in the Hawaiian sugar industry. Consequently, high hopes were held for this weedicide. In a series of tests on five farms, under varying conditions, using application rates varying from 5 lb. to 30 lb. per acre, disappointing results were obtained. Some control of grasses and weeds was achieved but it was not sufficient to warrant further trial. AK100 exhibited a distinct tendency to stimulate nut grass growth. This was possibly a result of reduced shading and competition from other species.

Polybor-chlorate.

Polybor-chlorate is a mixed weedicide consisting of various sodium borates and sodium chlorate. It is a partially soluble, non-selective weedicide acting as a soil sterilant. Due to its limited solubility (2 lb. per gallon) it is best applied as a powder.

Excellent results have been achieved with this weedicide during the 1954-55 summer at rates varying from 15 lb. to 25 lb. per 100 sq. ft. Two drains were treated early in December and at the end of March after some 40 inches of rain, control was very satisfactory. During this time only a few weeds germinated and persisted. Nut grass was retarded until early in April, when a few shoots appeared. Large tufts of guinea grass were completely eradicated.

Polybor-chlorate was applied as a powder after the drains had been cleaned, and then mixed with the first few inches of soil. Difficulty had been experienced in fixing the material on steep sides of drains and, for this investigation, comparatively flat drains were chosen. One drain carried irrigation water only a few days after treating and subsequently has been used several times, while the other has not yet been

Fig. 27—Control of nut grass by Polybor-chlorate, at rates of 25, 20 and 15 lb. per 100 sq. ft., heaviest near camera. Four months after application.

Fig. 28—Control of all weeds and grass with Polybor-chlorate after four months, at rates of 25, 20 and 15 lb. per 100 sq. ft. Control is still excellent after eight months.

used for irrigation. Control of grasses in the drain which was not used immediately was slightly superior although control in both drains was satisfactory. It seems desirable, therefore, that drains treated with the weedicide be left a week or two to allow the loose soil to settle. Showery weather just after application would assist greatly.

At the present time Polybor-chlorate is not available in commercial quantities, but should the supply position improve its use on a field scale is warranted. It may also be possible to reduce application rates below the 15 lb. per 100 sq. ft. level. The difficulty of fixing the material on steep sloping drain sides has yet to be overcome.

It was observed when treating one drain that some material drifted on to Noogoora burr and other broad leaved plants some 20-30 feet away. Some of these plants were killed. This action was no doubt due to the sodium chlorate content of the weedicide. Care should be exercised in the use of this material to ensure its complete isolation from cultivated plants.

Borascu.

Borascu is fairly similar to Polybor-chlorate in composition, consisting entirely of crude sodium borate ore. Results from the use of this weedicide at rates up to 50 lb. per 100 sq. feet have been very unsatisfactory and it cannot be recommended.

It must be remembered that the soil sterilant action of both Polybor-chlorate and Borascu is due to their boron content. Boron applied to cultivated fields at low rates has caused severe losses in cultivated crops and it must be emphasised, therefore, that these weedicides be applied only to those areas which will not be cropped.

Soil Conditioner Trials at Bundaberg

By N. McD. SMITH

[From time to time the Bureau has reported on its investigations into Krilium usage on intractable soils. Although considerable improvement has resulted on some soils the cost of the material rules it out for general farm usage.—EDITOR.]

Reference was made in the January, 1953, issue of the Quarterly Bulletin to laboratory tests with a soil conditioner (Krilium) on some of the intractable sugar cane soil types of Queensland. Extension of the work to small field trials was initiated and the following summarises the three laid in the Bundaberg area. The material was broadcast at the rate of 400 lb. per acre and mixed in the top three to four inches of soil by either rotary hoeing or discing.

Maroondan.—The Krilium was applied to a heavy black clay loam typical of a large section of the Gin Gin area. An improvement in crumb structure of the treated layer of the soil was noticeable for 12 months during which period a maize crop was grown. The effect, however, was lost following ploughing in preparation for planting cane. There was no difference in growth of the maize due to the treatment.

North Gooburrum.—At no stage did the 400 lb. per acre dressing of Krilium affect the physical condition of a forest, grey sandy loam. This particular soil is subject to periodic water logging.

Fairymead.—The results from an old alluvial clay loam followed those outlined for Maroondan. There was a noticeable "springiness" in the treated area and its crumb structure was much superior to that of the untreated section six weeks after application. The field was planted with cane eight weeks after application. The effects described were soon lost, so that a year after the dressing the treated soil appeared as hard and lumpy as adjacent untreated areas.

Conclusions.—The results of the three trials at the 400 lb. per acre level appeared to indicate that (1) the top treated portion of the soil must be retained in that position. (2) The effects on the clayey soils were quickly lost by cane cultural methods. (3) The sandy forest lands are not responsive to treatment. (4) The temporary benefits, where obtained, were far outweighed by the cost of material.

Sugar Experiment Stations Board Meeting

For the second time since this Board came into being on July 1st, 1951, it met in a country centre. Last year, on the occasion of the official opening of the Lower Burdekin Sugar Experiment Station, the Board met at Ayr; this year a meeting was arranged at Bundaberg on May 11th-12th.

The Board consists of the Hon. H. H. Collins (Minister for Agriculture and Stock), Mr. A. F. Bell, Under Secretary for Agriculture and Stock; Mr. J. W. Inverarity, representing the mill owners; and Mr. L. G. Scotney, representing the cane growers. Mr. N. J. King, Director of Sugar Experiment Stations, and Mr. C. C. Horne, Secretary, were present at the meeting.

The Board gave detailed consideration to the Bureau's budget for the year 1955-56, particularly in the light of the levy having been reduced to 3d. per ton of cane, and the crop being restricted to peak figures. Estimates of expenditure were ultimately approved.

Reports were received on the rebuilding programme at Meringa—where the work is now completed—the new building to be erected at Mackay Sugar Experiment Station this year, and the progress made for the new Head Office building in Brisbane. In regard to the latter, agreement has been reached between the Sugar Experiment Stations Board, the Central Sugar Cane Prices Board and the Sugar Board to contribute towards a composite building to house the three statutory sugar organizations.

Bureau representation at the Ninth Congress of the International Society of Sugar Cane Technologists was discussed and it was decided that the Bureau would be represented by the Director (Mr. N. J. King), who is General Vice-Chairman for the Ninth Congress, and by the Chief Engineer Technologist (Mr. J. H. Nicklin). It was also decided, after consultation with the A.S.P.A. and the Q.C.G.C. that the two industry Board members, Messrs. J. W. Inverarity and L. G. Scotney, would also attend. The Congress is scheduled to begin on January 4th.

The Board agreed to the second annual payment towards the Tractor Testing scheme which has been set up in Victoria by agreement between the Commonwealth and the various State Governments. For the time being the Queensland contributions towards this work are being met from Sugar Bureau funds.

A considerable number of Bureau staff matters were finalised at the Board meeting.

Mr. King to Visit Philippines

At the invitation of the Victorias Milling Coy. Inc., Mr. Norman J. King (Director of Sugar Experiment Stations) is to visit the Philippine Islands in October. Victorias Mill crushes 1,200,000 tons of cane each year and draws its cane supply from some 50,000 acres; the total area devoted to cane growing is 92,000 acres. The company conducts its own cane breeding and carries out an extensive programme of varietal, fertility and pest control trials. The directors of the company have requested Mr. King to organise the agricultural research activities of the area. It is anticipated that he will spend a month at Victorias.

Chlorotic Streak Control in Mauritius

By J. H. BUZACOTT

Chlorotic streak occurs on a wide scale in Mauritius. Fortunately much of the land is high, well-drained, red volcanic soil where the disease normally does not spread rapidly and where the introduction of clean plants ensures a clean crop for several years. On the other hand, on some of the lower soil types in the very high rainfall areas the soil remains in a saturated condition for long periods and under such circumstances spread of the disease is rapid.

Fig. 29—Chlorotic streak treatment plant, Henrietta Plantation, Mauritius.

The fact also that in Mauritius it is standard practice to ratoon for long periods, up to ninth or tenth ratoons, renders it very desirable to take steps to ensure that clean seed is used for planting.

Having regard for these facts it is not surprising that several of the plantations in Mauritius have installed hot water tanks for the treatment of their seed cane to control chlorotic streak disease. These tanks vary in type and are usually designed by the particular mill or plantation concerned. Two interesting ones were inspected during a recent visit to Mauritius. The one at Henrietta plantation is ingeniously designed on the lines of a Ferris wheel (Fig. 29). A steel-framed wheel, some twelve feet in diameter, is mounted so that it revolves in a concrete tank of water in such a way that exactly one-third of the periphery of the wheel is immersed in the water at any instant. The wheel is geared to an engine so that it makes exactly one revolution per hour; accordingly it takes 20 minutes for any point on the wheel to pass through the water bath. The rim of the wheel is provided with swinging shelves at intervals upon which the crates of plants are placed. A locomotive is used to provide steam for heating the water

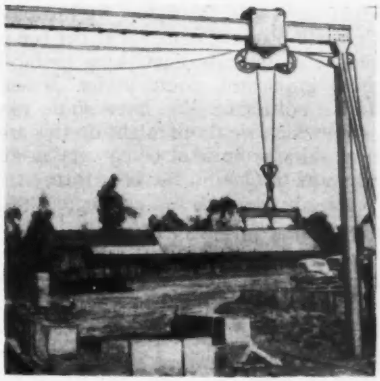

Fig. 30—Another treatment plant at Benares Mill, Mauritius.

bath. In this tank treatment is continuous and can be carried out at the rate of approximately 7,500 plants per hour.

The bath inspected at Benares mill consists of a simple concrete trough, fitted with an overhead gantry (Fig. 30). The water in this tank is heated by steam from the mill boilers and a tramline runs alongside the trough. The plants, which are loaded in crates, are lifted by the gantry and transferred to the hot-water bath from the trucks which are brought in on the tramline. This Benares tank is fitted with a centrifugal pump for circulating the water and should be easily convertible for the more exacting hot water treatment required for the control of ratoon stunting disease.

The Economic Use of Fertilizers*

By L. G. VALLANCE

Practically every operation necessary to produce cane on a cane farm costs money. Furthermore there seems to be very little indication that these costs are decreasing; in fact, it would appear that the reverse is the case. Most farms are now able to produce their peak without a great deal of difficulty, thanks to improved varieties, better strikes and disease and pest control. The search is now on, not for ways of producing more sugar, but to produce it more cheaply. In this regard new varieties can be of great assistance. Varieties, for instance, that will produce more sugar per ton of cane will decrease harvesting costs—a most important point under present day conditions. We have some new canes which we think might do this and they show promise of being very useful adjuncts to Q.50 in the near future.

Probably one of the most expensive items on a farm, as far as the direct outlay of money is concerned, is the purchasing of fertilizer. On practically all properties this expenditure is essential, and with very few exceptions it cannot be avoided. Let us, therefore, consider how the three major plant foods which the cane plant requires, *i.e.*, nitrogen, phosphate and potash, can be best supplied. In the first place there is no doubt that modern commercial fertilizers are excellent suppliers of essential plant foods. If used correctly they represent the most efficient and economical method of maintaining soil fertility. If used haphazardly, over the years they represent wastage not only of their own cost, but also of the missing cane tonnage which they have failed to grow. If such a policy is continued, the cost of production is adversely affected.

Every year the Bureau carries out a series of fertilizer trials on the various types of soil that occur in the cane growing districts. As the result of these trials there is no longer any doubt that chemical analysis of the soil will indicate the correct type and amounts of fertilizer which should be used in any particular field. Many farmers are now taking advantage of the free soil testing service supplied by the Bureau and are obtaining very good results by following the fertilizer and liming recommendations issued as a result of the analysis. If you have not had your soil analysed before I would suggest that you have it tested this year.

In addition to carrying out investigations with normal fertilizer materials such as sulphate of ammonia, superphosphate and muriate of potash the Bureau is continually testing other materials which supply plant nutrients. At the present time on this Station an experiment is being conducted in which urea is being compared with sulphate of ammonia as a supplier of nitrogen. There is also another where the efficiency of raw rock phosphate is being observed in relation to that of superphosphate.

In considering other materials which have fertilizing value it might be pointed out that a series of filter mud trials has been in progress on the Station since 1946. In these we have used different amounts of mud, with and without fertilizer. The effect has been observed on the yields of sugar and cane for both plant and ratoon crops. I think the results may be summed up by saying that there is nothing spectacular about filter mud when applied to the average soils of the Mackay district. While filter mud has a definite fertilizer value and it can supply nitrogen, phosphate and potash to the cane plant, we have not been able to show that mud is a better proposition than commercial fertilizer on soils of reasonably good tilth. In fact, on non-irrigated farms, I would say that mud is less reliable than fertilizers. When the weather is dry the mud is not sufficiently moist to decompose in order

*Address at Mackay Field Day, June 7, 1955.

to release the plant food in an available condition. On average land, such as on this Station, it is more economical to apply 3 cwt. per acre of mixed fertilizer than it is to transport and distribute about 40 tons of mud per acre. On some farms it is possible the reverse is the case as far as cost is concerned and then mud applications are worth considering.

It seems that filter mud has its most useful application on irrigated properties. Under conditions of sufficient moisture throughout the year the mud decomposes to make its plant food content steadily available. We have recently conducted a survey of farms where mud has been used at various times. There was a general consensus of opinion that irrigation was essential to obtain satisfactory results from mud applications. Moreover, to produce the best crops fertilizer applications were necessary in addition, particularly sulphate of ammonia as a top dressing. When applied in large amounts, say, 80 to 100 tons per acre, filter mud is useful for improving the physical condition of poor patches in a field of otherwise good tilth. However, it is apparent that under average conditions filter mud is not an economical substitute for fertilizer.

Molasses is far superior to mud as soil improver. Its value is so well known and has been referred to so often that there is little need to discuss it at this moment. However I would like to draw your attention to the increased benefit that may be obtained by applying a light top dressing of sulphate of ammonia to molasses treated areas. This enables the crop to obtain the best advantage of the improved soil fertility brought about by the molasses. Mr. Story has given some details of this, with particular reference to an experiment on a Mackay farm. These were published in the October issue last year of the Cane Growers' Quarterly Bulletin, and I think those of you who are interested in molasses applications would do well to follow the suggestions made.

In conclusion, I would like to repeat that using an unsuitable fertilizer increases your cost of production. Regular checking of the fertilizer requirement on the different blocks of your farm pays dividends. It is a sound idea to plan well ahead. Samples taken this year will give you information that will be useful for the next four or five years. There is no need to remind you that this service costs you nothing.

Forecast of Approved Varieties for 1956

In accordance with usual practice, the Bureau has prepared a forecast of the changes it is proposed to make in the approved variety list of 1955. Any interested farmers' organizations which consider alterations should not be made along the lines indicated, or wish to submit any other changes, are invited to submit their views to the Director of Sugar Experiment Stations before 30th November, 1955. **Any objections against varietal deletions or suggestions for additions must be accompanied by a detailed statement of the reasons for such objections or suggestions. No action can be taken in respect of late or unsubstantiated requests.**

Mossman—Cato and Pompey to be deleted. Q.59 to be added.
Hambledon—Cato to be deleted.
Mulgrave—Q.59 to be added.
Babinda—Q.59 to be added.
South Johnstone—Eros and S.J.4 to be deleted.
Mourilyan—Eros and S.J.4 to be deleted.
Victoria—Q.50 to be added.
Macknade—Q.50 to be added.
Inkerman—P.O.J.2878 to be deleted.
Proserpine—Q.58 to be added.
Bingera—Atlas to be deleted.
Isis—Co.301 to be deleted.
Maryborough—Q.42 to be deleted. N.Co.310 and Q.28 to be added.
Moreton—Q.28 and Q.42 to be deleted.

Early Relics of the Sugar Industry in Mauritius

By J. H. BUZACOTT

The history of sugar manufacture in Mauritius dates back for well over 100 years. In the early years there were no large mills like those now used throughout the industry and the cane was crushed between rollers propelled by oxen which walked around a confined circular track. The juices were concentrated by boiling in open pans. Although these small open pan mills are no longer used in Mauritius there are many of them still operating throughout India, and although some of them have installed machinery to provide motive power there are others in outlying places which still depend on oxen.

Fig. 31—Brick chimney from an early mill supporting a fig tree.

At one stage during the last century there were over 200 of these small mills operating in Mauritius and very common features of the Mauritian landscape to-day are the brick chimneys which are all that remain of the old mills. In the high rainfall area of the central plateau fig trees have adopted the chimneys as a host and these tall trees with "brick trunks" as shown in Fig. 31, are a rather novel sight.

As a monument to the sugar industry upon which Mauritius is practically dependent for survival, a full size model of the crushing plant and boiling house of an early sugar mill has been erected

Fig. 32—The decorative boiling house from an old Mauritius sugar mill. Note the open pans and thatched roof.

in the Pamplemousses Botanic Gardens. In the picture of the crushing plant (Fig. 33) it can be seen that the rollers were on a vertical axis, whilst the track traversed by the oxen which were used as motive power is also plainly visible. The rather decorative boiling house with its open pans and thatched roof is shown in Fig. 32.

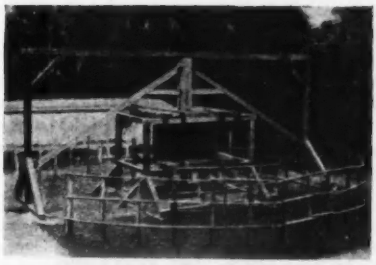

Fig. 33—The oxen-powered rollers of an early mill now erected in Pamplemousses Gardens, Mauritius.

Twenty-seven modern mills now handle a much greater crop with far more efficiency than the two hundred mills of earlier days. Nevertheless, although the small mills have now disappeared from Mauritius, in their time they played an important part in the development of the Mauritian sugar industry and the model in Pamplemousses Gardens well deserves the place it now holds in history.

An Oil Change Indicator for Tractors

A simply made indicator to record the work hours of a tractor has been in use by a Bundaberg farmer for many years. It is adaptable to any make of tractor and consists of a sector of 18 gauge galvanised iron with an attached movable pointer. The outer edge of the sector is marked in units denoting work hours and, as a work period is completed, so the pointer is moved forward until the time limit for oil change is reached.

The accompanying illustration shows details of the indicator and simplicity of construction.—N. McD. S.

Fig. 34—A simple indicator for recording tractor running hours.

Bound Copies of Quarterly Bulletin

During past years when binding the "Cane Growers' Quarterly Bulletin" for Bureau record purposes, bound copies have been offered to readers for a nominal charge to cover cost of binding. The same concession is being made once again and copies of Volumes 17 and 18, bound together in the usual cloth cover, are now available. Only a limited number of bound volumes has been prepared, and these will be used to supply orders as they are received. The cost of the bound volume is 10/–. The necessary application should be made to the Director, Bureau of Sugar Experiment Stations, Brisbane, enclosing with the order a remittance for this amount.—N.J.K.

Weed Succession in North Queensland

By J. H. BUZACOTT

For many years botanists have recognised that a species of plant may become dominant in a certain locality and, after remaining so for a number of years, will be replaced by an entirely different species. In such a place over a period of centuries a large number of species may attain dominance, some for short, and some for long, periods.

The writer's observations date back to 1926. Prior to this date the only well authenticated occurrence of a dominant weed was in 1914-15 when sensitive weed, waist-high, covered the Mulgrave flats to the exclusion of almost everything else. As a legume, from time to time assumed a position of major importance.

Fig. 35—A dense stand of Pink Burr.

For the past 29 years the writer has had an opportunity of observing a succession of weed species which have assumed dominance on the rich flats of the Mulgrave River near Gordonvale in North Queensland. This land is adjacent to canefields but is subject to severe flooding and accordingly is generally not used for cane production. Stock graze on it, and a fluctuation in their numbers may have some influence on the weed species represented, but it is probable that the severity of the flooding, outbreaks of pests and diseases, and the introduction of new plant species, accidental or otherwise, have been responsible in the most part for the great variety of species which have

this plant is valuable in adding nitrogen to the soil and, indeed, is used for that purpose in some of the cultivated fields in Indonesia. Its thorny nature, however, causes it to be classed as a pest in Queensland.

In 1926 pink burr occupied the country, forming a dense stand some eight to nine feet high. It is a plant which is not difficult to cut down whilst green but its fibrous bark renders it difficult to cut after the plant dies. The burrs are soft and not objectionable, but they densely mat the manes and tails of horses and adhere firmly to flannel clothes; in consequence they have some nuisance value. Pink burr is of interest because a fibre similar to

that of ramie can be produced from its bark and, a few years ago, the establishment of an industry to produce fibre from the weed was attempted at Ingham.

By 1928 pink burr had practically disappeared but its place was taken by a dense growth of needle burr some two to three feet high. Needle burr is a close relative of the green amaranth, a common garden weed in Queensland.

In the early nineteen-thirties, there appeared a plant of the Solanum family known as devil's fig. This is a woody perennial which, on rich lands, forms a shrub up to ten or twelve feet high with a stem which may reach a thickness of two inches or more. The plant is armed with sharp curved prickles like rose thorns and the profusion in which it flourished at this time indicated that strenuous measures would be needed to

Fig. 36—Devil's Fig, a pest well armed with thorns.

It is covered with long needle-like spines which inflict painful wounds. At this period, to ride a horse over the burr-covered flat was an experience. To avoid the denser stands of the weed the animal would progress in a series of bounds attempting to alight each time in a patch where the burr was less vigorous. The result was somewhat the sensation of being astride a kangaroo. The needle burr did not last more than a couple of years. Possibly this is due to the fact that it is quite palatable to stock in spite of its sharp thorns, and cattle, in particular, graze on it freely. On boiling like spinach, the spines become quite soft and, if young and rapidly growing, the plant is quite acceptable as a green vegetable in times of shortage.

eliminate it. Help came unexpectedly. Devil's fig proved highly susceptible to flood damage and a series of floods in consecutive years from 1935 onwards almost completely destroyed the potentiality of the species as a pest. Although devil's fig is still quite common it is no longer regarded as a serious threat. Indeed it is on a small scale proving a useful plant, as some ingenious North Queensland gardeners are using it as a hardy stock on which to graft the household tomato.

The decade from 1940 onwards was marked by the invasion of the river flats by noogoora burr. Probably originally brought to the district by travelling stock, this burr relished the rich sandy loams and spread at an alarming pace. For a number of years

Fig. 37—Vigorous growth of young noogoora burr.

it formed dense thickets up to nine feet in height through which man or beast could only force his way with great difficulty. In view of its poisonous properties in the early stages of growth it was fortunate that the stock did not attempt to eat it. Noogoora burr is a difficult plant to get rid of by cultivation as each burr possesses two seeds which germinate in alternate years; the destruction of the plant before seeding does not necessarily prevent its regeneration since there are always the seeds of the previous year to bring about reinfestation. Furthermore, the burrs are so easily transported by floods and stock that few places escape a continual bombardment of seed. Attempts

Fig. 38—*Hyptis capitata*—the latest pest of the river flats.

were made during this period to destroy the noogoora burr. Tractor drawn rollers were successful in flattening the plant but young plants sprang up freely again. Although the burr is highly susceptible to 2,4-D and similar hormone sprays the many inaccessible places in which it grows along the river banks necessitate a large amount of hand spraying which becomes expensive. In 1948 the terminal shoots of the burr were badly damaged by the fruit-spotting bug, and quite large areas were prevented from seeding, but this infestation took place in only one year. In the rainy season the noogoora burr is attacked by a wilt which sometimes kills out large patches, whilst in the cooler months a species of powdery mildew causes extensive damage. Whatever the cause noogoora burr is now fast being replaced by another weed pest.

Some five years ago a new weed was noticed growing on the flats. This was a tall herb which had pom-pom like flower heads resembling sunflowers without petals. It was identified as *Hyptis capitata*, an introduction believed to have originated in Mexico, and which was recorded in 1938 as a new weed to Queensland. It has as yet no common name and its generic name of *Hyptis* has already been allotted as a standard common name to the related *Hyptis suaveolens*, a weed which has in recent years appeared in profusion in many of the drier areas of the tropical north. *Capitata* has progressed rapidly and in 1954 has become the major pest of the river flats. It forms a dense cover at least eight feet high and the tiny hard black seeds are borne in such profusion that when walking through the plant they shower over the intruder like fine rain drops. The plant has an aromatic smell something like that of "stinking roger". It has not been in the district long enough to know its potentialities as a pest but the rapidity of its spread is amazing.

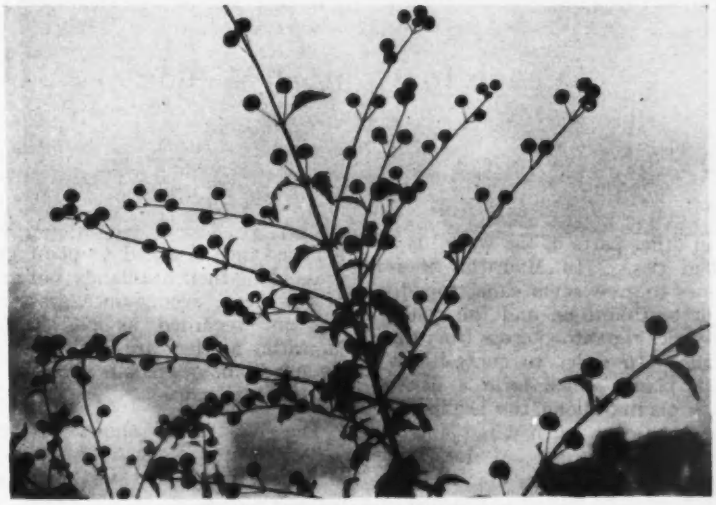

Fig. 39—The seed heads of *Hyptis capitata*.

It is remarkable that of the six species of weed which have been mentioned here as, at one time or another, being the dominant species on these river flats, not only are they all dissimilar but they even belong to entirely different families of plants. Sensitive weed is a legume, pink burr of the Hibiscus family, and needle burr an

amaranth. Devil's fig belongs to the potato family, noogoora burr to the sunflower and daisy family whilst *Hyptis capitata* is a member of the pot-herb family to which such aromatic plants as marjoram, sage, thyme and mint belong. Fortunately only one of the six species has proved a serious pest of sugar cane. This is noogoora burr, which has invaded many of the low lying blocks of cane in the Mulgrave area and proves a nuisance when harvesting.

What the next pest species will be it is impossible to forecast. In some sections there has been a build-up of pink burr and there may be a return to the cycle commencing with this plant. Noogoora burr is still very widespread and may again dominate the scene in the near future. On the other hand, a species such as the castor oil plant, which is at times a pest on the Barron River, may enter the picture. Whatever the plant, all observations seem to indicate that after a long or short period of dominance it is doomed to be succeeded by another species which is temporarily more favoured by the ecological conditions.

Weeds to Control Weeds

By J. H. BUZACOTT

The curious practice of planting weeds to control other weeds is widespread in Mauritius. In that country couch grass, or Bermuda grass as it is called in other parts of the world, is a very bad pest. In Mauritius it is customary to grow sugar cane crops to ninth or tenth ratoon and the couch grass invades the ratoon crops from the headlands. In order to control this invasion, plants which form a dense stool are planted along the headlands adjoining the cane when it is planted. The principal plants used for this purpose are the lily-of-the-valley, which in Mauritius is called "mugued", *Andropogon*, which is a grass that somewhat resembles guinea grass, and a miniature type of bamboo.

Cane growers in Queensland would look askance if asked to plant guinea grass along their headlands, but grasses of this type, even guinea grass itself, are not regarded as bad pests in Mauritius as they are easily pulled by the hand labour which is normally used to clean the crop.

The illustration shows lily-of-the-valley planted along a headland in a Mauritian cane field for couch grass control.

Fig. 40—Lily of the Valley planted on a headland to control couch grass.

Fig. 41—Contour planting in Natal.

Fig. 42—General view of contoured first ratoons (left middle distance) and velvet beans planted on contoured land (right middle distance), Isis mill area.

Fig. 43—Portion of the garden at Meringa Sugar Experiment Station.

Fig. 44—Five members of an Indian delegation discussing sugar industry matters in the office of the Director of Sugar Experiment Stations.

Fig. 45—Sugar cane lands on the Tugela River. This river marks the division between Zululand and the rest of Natal.

Fig. 46—Victorias Mill with the refinery on the right, Negros, Philippine Islands.

Fig. 47—Sugar cane at the foot of Mt. Pieter Both, Mauritius. The huge stone which appears to be balanced on the top of this mountain is a noted landmark.

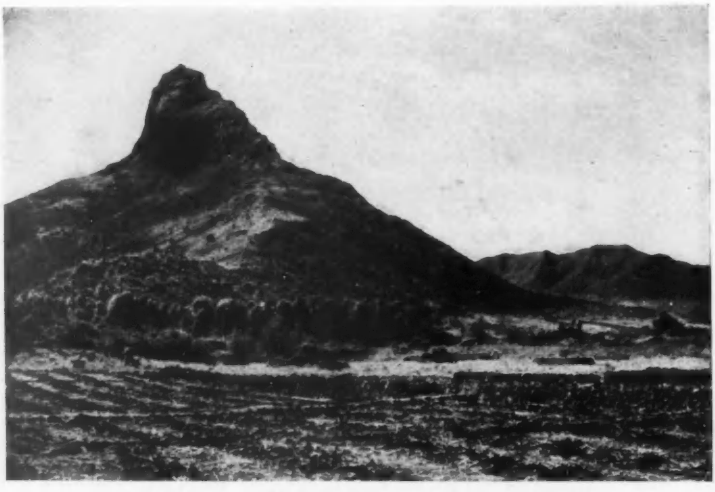

Fig. 48—Stony cane field at the base of Le Rempart, Mauritius.

Cutter-Dip-Planter

By H. G. KNUST

A single-row cutter-dip-planter (Fig. 49) recently demonstrated by a Bundaberg firm shows promise of finding a place in the sugar industry. During the small demonstration observed by the writer the machine functioned satisfactorily in every respect.

Fig. 49—The new planter showing method of drive for dipping device and fertilizer attachment.

The planter box, cutter blades, chain drive, chute, drill plough and fertilizer distributor are of the conventional type. The dipping tank and plant magazine is mounted at an angle of about 45 degrees through the planter box. The planting mechanism consists of 13 sockets (Fig. 50) each measuring about 12 inches long, 5 inches deep and 4 inches wide constructed of 14 gauge black iron sides and back and gridded front, and is mounted on endless chains driven by the bevel gear which also drives the blades. Sockets are synchronised with the cutter blade, and after each plant is cut into a socket it passes through the mercurial dipping solution from left to right, and then over a draining grid, through which the mercurial solution returns to the dipping tank; the plant then falls into the chute and is planted in the normal manner. The drive-shaft is fitted with a dog-clutch and is operated by a hand lever at the end of each row for the purpose of neutralising the plant sockets. This overcomes the dropping of plants on headlands, and plants are ready for dropping as soon as the machine enters the field.

Capacity of the dipping tank is 14 gallons, which is sufficient to completely submerge and wet the plants, but the dipping solution level needs regular checking for maintaining at the correct height. This can be simply attended to through the draining grid.

Although the quantity of dipping solution used per acre does not exceed 10 gallons—used at the rate of 8 gallons per acre when demonstrated—and the solution is being repeatedly added to during the day, a wise precaution to follow with this and other small capacity dipping or spraying units would be to discard the solution at the end of each day and commence the following day's planting with entirely new solution, thereby avoiding the use of material in which fermentation may have commenced.

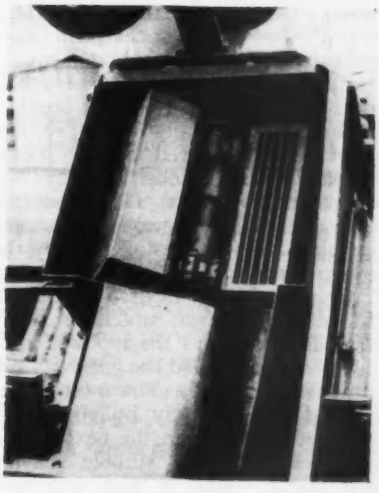

Fig. 50—Showing detail of two of the sockets in the plant magazine.

Ratooning in the Lower Burdekin*

By NORMAN J. KING

On the occasion of the official opening of this station just twelve months ago I spoke to you, among other matters, on the problem of ratooning in this district. I cannot help recalling that some 25 years ago ratoon crops were almost unknown in the Lower Burdekin, and whenever an attempt was made to grow ratoons, the result was normally a failure. A succession of field trials inaugurated by the Bureau at that time soon disclosed that the problem was one of nitrogen deficiency in the local soils, and that successful ratoon crops were not only quite practicable, but were financially profitable if correct dressings of sulphate of ammonia were applied after harvesting the plant cane. It seems hardly credible to-day that the use of this important fertilizer was so little appreciated at that time.

However, the use of sulphate of ammonia was not the entire answer to ratooning. There was a physical obstacle which was created by the throwing of interspace soil on to the cane row during the preparation and maintenance of water furrows. This practice left the cane stubble on a ridge after the harvesting of the plant cane, and subsequent watering did not supply the necessary moisture to the young roots coming away from the stubble. During the mid thirties the first stubble shaver was introduced into the industry and was demonstrated by the Bureau in this district. The implement, although effective, was cumbersome and slow and was not taken up by the growers as the answer to their problem. Later, a local grower devised a successful ratooning implement which cut away the ridge as well as the top section of the stools and moved the cut-away soil into the interspace. The most recent issue of the Quarterly Bulletin which will reach you within the next month describes two more stubble shaving implements. One of these has been developed by a Queensland cane grower; the other by a Philippine Sugar Co. Both are driven by the power take-off of the tractor and apparently do an excellent job at a relatively high speed.

I feel confident that the combination of correct sulphate of ammonia applications and land re-levelling (as I term the process of cutting away the ridge) will allow of successful and profitable ratooning in this district. When discussing this matter with a local man recently I questioned whether Lower Burdekin growers were on the right track in growing only plant cane, and his reply was that 800 growers can't be wrong. My answer was that all the other cane growers in the world can't be wrong and the 800 local growers right, because, with the exception of Java, all other sugar growing countries in the world—as well as all other districts in Queensland—grow from two to six ratoon crops. In Java the Government allows only plant cane to be grown so that the land can be used for rice in the following year.

Those of you who do grow ratoons, and I know there are many very successful ratoon growers in the district, will have learnt that a ratoon crop requires just as much care in fertilization, irrigation and cultivation as does the plant cane. Many of the failures are due to leaving the ratoons to fend for themselves while preference is given to the plant crops.

It is sometimes claimed, and perhaps with some justification, that water penetration in ratoons is slower than in plant cane and that, consequently, watering is more difficult and crop development slower. This is probably quite correct on some of the older land where the soil tends to pack and where irrigation water has had a detrimental effect on soil tilth. There are ways and means of improving this position. Reports which I receive from this

*Address at Field Day, June 9, 1955.

district disclose an increasing interest in green manuring of land during fallow periods. The ploughing-in of any vegetable material will improve soil tilth, and when the material ploughed in is a green manure of the bean type it has the added advantage of supplying nitrogen for the use of the succeeding cane crop. The incorporation in the soil of a body of vegetable material results in its decomposition and the formation of humus which assists in maintaining the soil in an open condition and making it more penetrable to irrigation water. During recent years some growers in this district who grew two green manure crops during a fallow period claimed better water penetration during irrigation, but it is not known for what length of time this improvement persisted.

Another material which will assist in maintaining an open condition in the soil is sugar mill bagasse, and this material will have longer lasting effects than will a green manure crop. A couple of years ago I first saw this material being used on sugar cane soils in Jamaica. There it was spread on the fields after the final ratoon crop was harvested and large rippers worked both ways across the field. It was apparent that as the huge tynes cut gashes in the soil the bagasse ran down the channels and formed partitions in the soil mass to a depth of two feet. The bagasse remaining on the surface was worked into the surface soil. Nearly two years ago we began experimenting with bagasse on our Mackay Experiment Station. There we applied over 40 tons per acre on fallow land, used a ripper to get some of it down into the subsoil, and then planted the field with cane. When the plant crop was harvested in 1954 the bagasse treated areas produced 42 per cent. more crop than the untreated land. I think there is room for experimentation in the Lower Burdekin with bagasse. It would assist in keeping the soil open and uncompacted and thus allow better and faster water penetration on lands which are inclined to become hard and difficult to irrigate. Bagasse is more resistant to decomposition in the soil than is a green manure crop and the material would exert a beneficial effect on soils for a considerable period.

With these three factors—adequate sulphate of ammonia, land re-levelling after harvest, and a soil amendment to prevent soil compaction—there shoulp be no obstacle to the growing of successful and profitable ratoon crops in this district.

Bagasse as a Soil Improver

Little is yet known in Queensland regarding the benefits of bagasse as a soil improver. The trial on Mackay Experiment Station has given good results, and the treatment is likely to improve soil conditions in other districts. Irrigated lands which tend to set hard after watering—such as some of the Lower Burdekin soils and some of the red loams in South Kalkie—should benefit from bagasse applications. Organic matter is the best soil conditioner, and bagasse is resistant to decomposition and lasts much longer than a green manure crop. It would be interesting to observe, also, what effect bagasse might have on the verticillium trouble being experienced by some South Kalkie cane growers.

A good green manure crop will add to the soil no more than two and a half tons of **dry** organic matter per acre, and this can be done only every four years. Sugar mill bagasse, which normally contains approximately fifty per cent. of dry material, can be applied to the soil during a fallow period and cultivated in, or applied as a mulch after each crop. Even a ten ton per acre application would contain some five tons of dry organic material—twice as much as in the good green manure crop, and our Mackay experiments have shown that much heavier dressings can be used.

—N.J.K.

Cane Varieties as a Solution to a Harvesting Problem

By NORMAN J. KING

The harvesting of recumbent and tangled cane crops has always attracted a special cutting rate to compensate labour for the slower output of tonnage. This extra amount was accepted by the growers of the State as a reasonable payment for the increased effort required. In very recent years, however, the smaller and less experienced labour force available for harvesting has been insufficient to cope adequately with the larger crops. One of the results has been a demand for much higher margins for recumbent and tangled cane. The position which has arisen is a not unexpected corollary of a period of full employment. There is a general disinclination to cut lodged cane and a trend towards seeking less arduous work in other industries. There is at present no indication that the sugar industry will return in foreseeable time to a period of effective labour sufficiency and there is consequently no promise of amelioration of the position from that direction.

From the cane grower's point of view the problem of harvesting lodged cane at a price which gives a reasonable net return is a serious one. In his never ending attempt to raise his standard of efficiency the production of more tons of sugar per acre is his goal. To achieve this he fertilizes more heavily, cultivates more assiduously, irrigates more regularly, protects the crop against pests and frequently incurs added expenditure in ensuring the use of disease-free plants. The net result is that he makes the crop more liable to lodge. His extra expenditure in chasing greater efficiency frequently results in a reduction of net return. In addition to the increased harvesting charges he generally suffers further by a lowered sugar content, by an increased liability to rat damage and stalk rots and by a risk of indifferent ratooning brought about by the movement of stools.

It may be stated that this state of affairs is contributed to by over-fertilizing, and by the climatic and soil conditions obtaining on the farm. The grower cannot control the weather nor can he, in many cases, solve the problem by recourse to using less fertilizer. The lodged cane problem is met in its acutest form on alluvial soils which are so naturally rich as not to need fertilizing to any appreciable degree. These lands—some of them, but not all, new—have more than adequate supplies of plant foods and many of them are replenished by periodic flooding. It has been suggested that a solution might lie in the growing of more ratoons, thus lengthening the period between fallows, and bring about a quicker depletion of available plant food reserves. Even if such a practice were successful it would still not solve the problem of too-vigorous growth of the plant and first ratoon crop following each fallow.

The other important factor in addition to fertilizer and climatic conditions, and one which has not yet been considered, is cane variety. This might appear at first glance to be so obvious a solution that there is little necessity to emphasise it. It should be kept in mind, however, that during the development of the industry there has been a strong accent on the breeding of canes with higher capacity to produce. Cognisance has been taken of the necessity to maintain sugar content above a certain minimum figure, but in general the industry has demanded and has been given cane varieties each more vigorous than the one which was grown before. A perusal of varietal statistics over a period of years discloses the rejection by the growers of less vigorous types and their replacement by higher yielding canes even though, in some cases, the newer type is less rich in sugar than the one it displaced. As

examples one need only quote the disfavour with which sweet varieties such as Oramboo, Korpi, S.J.2 and Clark's Seedling are viewed to-day. They have been supplanted by more vigorous types but their successors are, in general, lower in sugar content although producing more sugar per acre. The result has been that the Approved Variety Lists now contain the canes which have been preferred by the growers, and these do not necessarily include less vigorous ones which might be suited to the very rich soil conditions under discussion.

Nevertheless the production, by breeding, of a group of less vigorous varieties which might resist lodging is probably not so difficult a task for the cane breeder as was set him by the industry in the past. In fact, the cane breeders are generally embarrassed by too large a number of varieties which just fail to equal the performance of existing commercial types; they are less vigorous than the approved canes in varying degree but occasionally—and this is of prime importance—are higher in sugar content.

It is almost axiomatic in cane breeding that high sugar is more readily obtainable in a cane of low vigour than in one of high production capacity. It should not be so very difficult, therefore, to produce a type of cane suited to the over-rich soils on which the lodging problem is causing so much concern.

The aim would be to replace the existing, too-vigorous varieties with types which would produce lower tonnages but which would remain erect and be harvestable at award rates. The question arises as to how much tonnage could be sacrificed without reducing net income. Since the harvesting rate, the value of sugar and the tonnage of the crop all enter into the calculation a lengthy table would be necessary to answer the question fully. But it is of value to consider a few examples and to examine the figures in each case.

Comparison of Returns.

The normal cutting and loading rate for burnt cane in North Queensland is 14/1½ per ton. Let us examine the case of a 40 ton crop of cane which has lodged and for which £1 a ton has to be paid to the cutters. With sugar at £40 a ton and cane at 14 c.c.s. the net value is £2/15/4 per ton of cane, or £110/13/4 per acre. To obtain a net return of £110/13/4 per acre in straight cane which is cut for 14/1½ it would be necessary to grow only 36.2 tons per acre; this is assuming that both crops were of the same sugar content.

If we take the case of a 40 ton lodged crop which is testing 13.0 c.c.s. against a standing crop of 14.0 c.c.s., the difference is more marked. Here the lodged cane would be worth £3/8/1.6 less £1 for harvesting—a net return of £96/5/4 per acre. Standing cane of 14 c.c.s. would have a net value of £3/1/2½ and the grower would require only 31.5 tons per acre to give a net return of £96/5/4 per acre.

To carry the case a little further and assume 14.0 c.c.s. in the standing cane and 12.0 c.c.s. in the lodged crop, it is found that only 26.8 tons of standing cane would be required to give the same net return of £81/17/4 as would be obtained from a 40 ton crop of lodged cane.

This is not taking the position to extremes; the recumbent portion of a block of cane is frequently more than two units lower in c.c.s. than the adjacent standing cane of similar variety and age.

During the past harvesting season £1 per ton for lodged cane would have been a very modest cutting rate. If consideration is given to the lastmentioned case on the basis of 25/- per ton cutting and loading rate it is found that the same net return would accrue to the grower if he produced a 23.5 ton per acre crop which was erect and harvested at award rates.

However, these examples are based on a similar net return. Cane growers might anticipate an increased net return by growing the correct variety—one which is sufficiently less vigorous to resist lodging but which is also higher in sugar content. Consideration has

been given above to a variety which tested 14 c.c.s. when erect and 12 c.c.s. when recumbent. Let us compare that recumbent cane with a new variety testing 15 c.c.s. when erect. A similar calculation would be as follows: The lodged 40 ton crop of the old variety returns £81/17/4 net, but 28 tons of the new variety testing 15 c.c.s. and cut at award rates returns £95/15/5, an increased return of £13/18/1 per acre.

Such a result is not unlikely of attainment. Experience with many thousands of selected and tested seedling canes has demonstrated that with the sacrifice of 30 per cent. of vigour (40 tons to 28 tons) an increase of one unit of c.c.s. would not be difficult to obtain. Several such seedling canes, selected during recent years when emphasis has been placed on high sugar content, have already been planted for observation on some of these rich river flats. Their capacity to give a high c.c.s. early in the season has already been proved; it remains now to ascertain whether under very rich soil conditions, and in a tropical environment, they can resist lodging in a 28 to 35 ton crop. If they can, the cane breeders will have made a very important step forward in maintaining economic stability in the industry.

The advantage of growing cane with high average sugar content has always been recognised by the growers of Queensland, and evidence of this is found in the disincliation of many growers to fill weekly allotments early in the season when cane is immature. It is all the more surprising therefore to find that, over the years, early maturing varieties have faded into obscurity—frequently because of lack of vigour. When one considers the high premium paid under cane prices legislation for high sugar content, one is driven to question whether sufficient attention has been given to examining relative net returns from a range of cane varieties—even in the absence of lodging.

Conclusion.

The local sugar industry is faced with a phase of restriction. On the majority of farms peaks will be introduced to limit production to Australian requirements plus a fixed export quota. The time is opportune therefore to attempt a solution of the lodging problem by growing, on a proportion of the land at least, a less vigorous higher-sugar variety. If a suitable cane becomes available its cultivation could improve the average c.c.s. of the farm and, at the same time, enhance farm economy in another direction by keeping harvesting costs down to award rates.

Ratoon Stunting Disease

The Bureau has recently issued a Technical Communication dealing with ratoon stunting disease. This publication contains a survey of the disease since it was first discovered in the variety Q.28 in Mackay. Among the various headings can be found discussions on distribution of the disease, the symptoms, means of transmission, the causal agent, control measures and the implications. Copies will be forwarded to all Cane Pest and Disease Control Boards as well as to other interested persons and organizations, but there will be spare copies for any cane growers who wish to be informed on technical aspects of this problem.

Ratoon stunting disease is undoubtedly the major disease of the sugar industry at the present time and is responsible for very serious crop losses. A campaign is well under way in all districts for its control, but the co-operation of every grower is essential if it is to be eventually eliminated from our crops.—N.J.K.

The Varietal Picture in the Mackay District*

By NORMAN J. KING

One cannot but notice, and view with some alarm, the trend towards Mackay becoming a one-variety district. Reference to varietal statistics discloses that only 13 years ago some 80 per cent. of the Mackay district crop was made up of five varieties—each of the five contributing a reasonable proportion of the total. Since that time the position has changed drastically and in the 1954 crop the six Mackay mills—excluding Plane Creek and Proserpine—had such a preponderance of the one variety, Q.50, that it averaged 88 per cent. of the total tonnage crushed; in two individual mills the percentage exceeded 90.

This, I repeat, is a matter for concern. The general suitability of Q.50 for Mackay soils is proved by the extent to which it is grown, but it is as well known to you as it is to me that Q.50 possesses certain disabilities which make it unsuitable for planting on 100 per cent. of any farmer's assignment. The worst drawback of this variety is its susceptibility to red rot late in the harvesting season. Generally you can be sure of having severe red rot damage in a year like 1949 when a dry late winter and spring was followed by storm rains in October and November. The serious effects of a bad red rot infestation are known to you. In the year to which I have referred the weekly c.c.s. figures fell approximately two units in the short space of six weeks between early October and mid-November. With c.c.s. values at approximately 7/- a unit such a fall is sufficient to make the difference between profitable and unprofitable farming.

Naturally your first reaction to these remarks will be to ask what you can do about it, and what other varieties are available to replace some of the Q.50. My answer is that the variety position is excellent in Mackay to-day, and there is an excellent batch of canes from which to choose.

Before discussing these in detail I would like to go back a few years to the time when Q.28 was the major variety of the district.

The history of Q.28—its rise and fall—is familiar to most of you. The reason for its decline in production is now well known and a cure has been found and applied. Ratoon stunting disease exacted its toll of the susceptible Q.28 and the district was indeed fortunate that it could be replaced quickly by Q.50. But, apart from its susceptibility to this disease, Q.28 was an excellent cane variety and it possessed that outstanding attribute of being resistant to red rot. Why, then, is Q.28 not returning to favour as a complementary variety to Q.50—one for early and mid-season cutting, the other for late harvesting. Ratoon stunting disease is now readily cured and crops of Q.28 can be maintained in disease-free condition by the application of simple rules of farm hygiene.

At a later date your local organizations pressed us to release C.P.29/116 in this area. This we were pleased to do, and one of the reasons for our action was again the fact that the variety was resistant to red rot disease and that it maintained its c.c.s. right to the end of the harvesting season. However, C.P.29/116 arrows very freely and it is doubtful whether it will ever attain popularity because of this characteristic.

Then in January last we placed on the approved variety list the variety Q.58. This is one of our more recent productions and it has as parents P.O.J.2878 and Co.290. During its history as a seedling cane Q.58 has consistently yielded more sugar per acre than has Q.50. It has a compact stool and has good early sugar which it maintains throughout the season. Its habit is erect and it has shown good resistance to winds which were strong

*Address at Mackay Field Day, June 7, 1955.

enough to make other varieties lodge. Although the leaves are narrow the ground cover is good, and the variety looks well suited to mechanical harvesting. Q.58 is less susceptible than Q.50 to red rot and one very pleasing feature is that in a frost resistance trial at Pinnacle it was the outstanding variety.

There are at least three more of our seedling canes, which have been through their advanced trials, which appear good enough to distribute and place on the approved list. With these coming forward the variety picture in this area is very satisfying.

It is apparent, therefore, that the variety position in this area is sound and that there is little, if any, excuse for it becoming a one-variety area. There is always danger in restricting a very large acreage of soil, like the Mackay valley, to a single cane variety. Without attempting to be an alarmist I would be failing in my duty to you if I did not point out such dangers. A new disease in epidemic proportions is not an impossibility. During the past two harvesting seasons a new fungus disease of the verticillium type has caused a considerable number of ratoon failures in the Bundaberg and Isis districts; by failure I mean a complete loss of the ratoon crop. What would be the effect if such a disease occurred widespread in this district and if Q.50 were susceptible to it? That is one advantage of a diversified form of agriculture—you do not lose all crops because of a disease outbreak. But since we cannot have diversified agriculture in the sugar districts let us ensure that diversified varieties are grown; there is safety in that proposal.

My message to you on this Field Day is to restrict your acreage of Q.50 to not more than 75 per cent. of your harvestable acreage. Plant the other 25 per cent. with Q.28, C.P.29/116 and Q.58. On rich river soils you will, of course, use the canes most suited, but in no case should any variety constitute more than three-quarters of your net assigned acreage.

The average production per acre in the seven local mill areas over the last six years has shown a 20 per cent. increase over the pre-war period, and an increase of that magnitude is something to be proud of when related to an area of over 100,000 acres. This increase can be further improved by more selective use of modern cane varieties, and our field trials, conducted on your own farms, have demonstrated that the canes to achieve that improvement are already available to you.

Soils of the Cooktown Area

The Director (Mr. N. J. King) and the Senior Adviser at Meringa (Mr. G. Bates) visited the Cooktown area late in July. They spent some days gaining first hand experience of the agricultural soils of that area and, in particular, of the McIvor and Morgan River districts. There are extensive acreages of red volcanic loams carrying, mostly, a poor forest cover although some of it is rain forest. A curious feature of these lands was the occurrence of so much Zamia palm—a plant which is normally seen only on very poor country. Some of the red soil is being utilised for peanut growing, but the bulk of it is unimproved grazing land.

The red soils are derived from basalt, as are the well known red loams of Innisfail and Bundaberg, but they lack the excellent crumb structure which characterises the sugar lands of those districts. Instead, the soils are powdery and are subject to severe wind erosion. A few samples were brought back for analysis, and another marked difference between them and the more southern red volcanic soils was their low phosphate content.

Maybe, in the distant future, sugar cane growing may extend to this far northern outpost, but if it does the agriculturists will encounter new problems in sugar cane nutrition.

—N.J.K.

Random Gleanings

An illustration elsewhere in this issue shows the personnel of the Indian Sugar delegation which recently visited Queensland. The members of the delegation spent a day with Bureau staff in Brisbane, discussing organization of the Bureau and the way in which Cane Pest and Disease Control Boards operate under Sugar Experiment Stations Acts. They were particularly interested in our approved variety legislation and in the manner in which disease and pest control is carried out. The extension of varietal and fertility trials from Experiment Stations to farmers' properties also interested the delegation. The members who had milling interests discussed at length the operation of the mill technology division and the way in which the investigational work in mills is conducted. In common with most overseas visitors they were intrigued by the high quality ratio of our canes, and were curious regarding our breeding and selection programme.

The "inverse yield nitrogen law" lays down, in its simplest terms, that a crop variety with a low nitrogen content will be more vigorous than one with a higher nitrogen content. It suggests that a cane breeder could, by selecting types low in nitrogen, thereby obtain the best producers. Very little work has been done to apply this theory. Like many apparently simple propositions there are practical difficulties in the way; obtaining a representative sample of the complete plant is one of these. Nevertheless, an attempt will be made this season to determine the amount of nitrogen in each plot of a varietal trial on Meringa Station. Should this initial step indicate any confirmation of the theory, the method will be extended to other trials. However, even should low-nitrogen varieties be proved to be the best producers they may not necessarily have a favourable sugar content.

Recent reports from Taiwan highlight the startling success of N.Co.310 in that country. It is stated that this imported variety now constitutes 45 per cent. of the area under cane.

Before the P.O.J. canes spread around the world, and P.O.J.2878 became an important variety in many sugar countries, it was unusual to hear of a cane variety which was successful beyond the boundaries of the one industry. Badila was not grown extensively outside Australia, S.C.12/4 had its home in Cuba, Louisiana did not make a success of varieties from other lands, and Lahaina and H.109, although the backbone of Hawaii, were not commercialised elsewhere. But now N.Co.310, raised in Natal and the major variety of that country, is performing wonders in Taiwan, has been released in Louisiana, and is making a bid for prominence in South Queensland. Even though all four areas are in the subtropical zone, the success is worthy of mention.

The so-called "verticillium" disease in parts of Bundaberg and Childers has caused some concern to growers whose crops have been affected. Following requests from local farmers' organizations, a Bureau pathologist has carried out an initial survey of the position, and now an agronomist has been stationed permanently in the Bundaberg district. During the current season he will be collecting information on occurrences of the trouble, initiating a comprehensive series of field trials in search of a protective or curative treatment and, in general, doing everything practicable to solve the problem. It is by no means certain that the verticillium fungus is the sole cause of the ratoon failures. There is likely to be some predisposing cause which allows the fungus to invade the stubble and the solution might lie in discovering this cause. The co-operation of growers in assisting with the experimental work may hasten the solving of the problem.

The Louisiana Sugar Bulletin frequently makes reference to progress in the control of ratoon stunting disease in that country. Recently we note that sugar scientists there were discussing the use of radio active material in the treatment of sugar cane infected with this disease. The use of these wonderful tools, developed by modern science, is becoming commonplace these days, and Queensland workers will be more than interested to watch for results of the Louisiana work. There has probably never been, in the history of sugar growing, such a concerted and concentrated attack on a disease problem as is now current with ratoon stunting disease. Investigators in many countries are tackling it from all angles, and, with such a weight of effort and a varied viewpoint, a better understanding of it must soon emerge.

Work conducted in the Florida sugar industry on the problem of ratoon stunting disease showed that, as in other countries, poor germinations frequently followed hot water treatment. It was believed there, however, that the buds were not, in general, killed by the hot water, but were rendered dormant. Trials were initiated whereby the treated setts were subsequently dipped into solutions of various chemicals before planting—in an attempt to improve the germination of the buds. A substance called sodium peroxide gave the best results when used in 2 per cent. solution. It is interesting to speculate on the action which this chemical could have on the buds. It is, of course, a strong oxidising agent and as such has germicidal properties. Some trials in Queensland would be worthwhile although the mercurial, Aretan, which is used here, gives good results if planting conditions are favourable.

To measure the approximate contents of a 44 gallon standard drum, insert a stick perpendicularly through the bunghole and measure the wetted section. Taking 1 in. to equal $1\frac{7}{16}$ gallons it is a simple matter to work out the contents. The method is very handy for growers possessing a power spray unit having an upright standard 44 gallon drum as a container.

An observation made by Mr. Buzacott, on his return from South Africa this year, was that the variety Co.281 had not been rejuvenated by hot water treatment in that country, and that there was possibly some other reason than ratoon stunting disease to account for its decline in vigour. This suggests some interesting investigations for the pathologists, particularly in view of the Bureau belief that ratoon stunting disease is the principal cause of varietal running-out. Co.281 was never a commercial cane in Queensland, although it performed satisfactorily in trials in the early thirties in South Queensland, but there are stocks of this variety in Bureau plantings and steps have already been taken to compare the yielding capacity of diseased and healthy plants. Co.281 has several good features and it is possible that in these days of specialization a place may be found for it in frosty or droughty localities.

By watching internal stalk condition it is possible to ascertain any deterioration with consequent loss of sugar content. This fact was strikingly illustrated during September, 1954, in a five acre field of Q.55 ratoon at Alloway near Bundaberg. Although not set down for immediate harvest, stalks from this 46 t.p.a. field showed initial internal symptoms of stem rots when examined and resulted in a drastic change of harvest planning by the grower. During the 12 day harvest period which covered fine, mild weather the mill c.c.s. over 20 samples dropped slowly from 13.72 per cent. to 12.81 per cent.

Temperatures Inside Containers in Hot-Water Treatment Tanks*

By G. WILSON

Since the writing of this article the Bureau has, in certain cases, recommended that the treatment be increased to three hours at 50° C. This was designed to deal more effectively with the very small percentage of plants which, it was suspected, were not cured in two hours.
—EDITOR.

Introduction.

The hot-water treatment commonly employed in Queensland to eradicate ratoon stunting disease from sugar cane planting material requires that the cane be kept for two hours in contact with water at a temperature of 50° C. Steindl found that a cure could be effected by treatment at that temperature for one and a half hours. Since the practical application of the treatment would involve diverse types of cane, possibly thicker than that used by Steindl in his investigations, and because the standard of control might vary due to larger bulk of material and varying types of equipment, the two-hour period was recommended. Hughes emphasised the need for maintaining the correct temperature if every plant were to be cured.

In Steindl's investigations the cane plants were supported separately in a wire grid in a bath of continuously circulated water with an ample source of heat available to rapidly check any incipient drop in temperature. When the curative treatment was adopted on a large scale in many Queensland cane-growing areas in 1953 the equipment used varied considerably. Descriptions of some of the types of treatment plants have been described by Knust and Greenaway. At some centres the plants were treated in baskets constructed of iron framework and wire mesh sides. At many centres plants were treated in sacks containing 80 to 110 lb. of cane in each, from fifteen to thirty of these comprising a batch according to the size of tank used. The usual source of heat was steam from mill boilers, either direct steam which varied from 180 to 50 p.s.i.g. according to fluctuations in cane supply and other factors, or indirect steam through various mill channels at a lower pressure. At one centre, electrical heating elements were employed in 1954. Circulation of the water in the treatment tank varied from intermittent disturbance by movement of the containers, to centrifugal pumps of widely varying degrees of efficiency and rates of circulation.

Although sacks are cheap and readily available and simplify transport to distant farms, it appeared likely that they could not compare with wire mesh baskets in allowing free access of hot water of the correct temperature to replace that chilled in contact with the cold cane plants. An observation by the writer at the end of the 1953 season indicated that this supposition was true in one preliminary test. Further investigations were made at several treatment plants during the 1954 season.

Details of Tests, Sacks *v.* Baskets.

Temperature inside containers and in the tank water were read on brass-clad, long-stemmed thermometers. On the calibration scale, 10° C. covered a length of 1⅝in.; with rulings at half-degree intervals, an estimation of 0.1° C. was easily made. Thermometers were inserted half to two-thirds of the way down the central axis of the mass of plants in the containers. Since there was some danger of breakage if the thermometers were used as levers to prise the plants apart, a piece of galvanised iron pipe of sufficient diameter to receive the half-inch diameter stem was first thrust down through the plants. The lower end of the pipe was cut away on a long slant

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and the remaining half-section perforated to allow free access of water to the mercury bulb of the thermometer. The three feet long thermometer stem was then inserted through the pipe. Tests with thermometers so guarded and thermometers freely exposed showed that this device did not affect the sensitivity of the thermometer. It must be emphasised that for tests of this nature to be of any value the packing of the plants in the container and the ratio of water to cane in the tank must approximate normal working conditions. All the tests to be described were made in tanks containing batches of normal size. The method of inserting the guarded thermometer was used in bags or baskets of plants that were randomly selected from the batch being treated, and had passed through normal handling and transporting. It was not considered that the normal packing density could be simulated by placing plants in containers after the thermometers had been inserted. The method used slightly increased the volume of water in the bag by displacing plants, and this probably led to the results in bags being better than they normally would, but this did not defeat the object of the tests since even with this slight advantage bags were found to be inferior to baskets. The several thermometers used in each test were checked against a standard and the necessary correction applied to all readings.

Temperatures were first recorded in sacks of plants which were not agitated during treatment. The circulation rate of 9,000 g.p.h. turned over the tank contents of 1,350 gallons of water every nine minutes. This is referred to hereafter as the circulation cycle. The ratio of weight of water in the tank to the weight of cane was 5.6 to 1. Since the cold cane absorbs heat very rapidly and causes a drop in tank temperature which cannot be completely compensated by the available steam, it was customary to immerse the plants in water at 52° C. The absorption of heat can lower this to 50.5° C. in two minutes. The desirability of slowing down this drop in temperature by admitting ample steam is referred to below.

In the first test the water was at 52.8° C. when the sacks were immersed but fell to 50.0° C. after five minutes; it rose steadily to 51° C. at 20 minutes, but dropped to 50.3° C. at 25 minutes, and remained there for the rest of the treatment period. Two apparently identical sacks each containing 100 lb. of cane required 25 minutes and 100 minutes respectively to reach an internal water temperature of 50° C. This high variability in the behaviour of individual containers in the same batch was experienced frequently at several treatment plants. It can be attributed only to differences in the density of the packing in the containers.

In a similar test, but with a water-to-cane ratio of 8 to 1, because the presence of test baskets altered the loading capacity of the tank, immersion was made at 52° C. Tank temperature fell to 50.5° C. at five minutes, 49.45° C. at 10 minutes, rose through 50° C. at 15 minutes to 50.3° C. at 30 minutes, and was maintained between 50.0 and 50.3° C. subsequently. Two sacks containing 95 lb. of cane each, required 33 and 45 minutes respectively to reach 50° C. at their centres.

In a third test at another tank, the water to cane ratio was 9.6 to 1, and the circulation cycle was 47 minutes. Two sacks required 75 minutes to reach the required internal temperature. In this treatment the tank temperature of 52° C. fell to 51° C. at two minutes, to 50.3° C. at seven minutes, to 50° C. at 15 minutes, and then rose to 50.25° C. at 22 minutes, and was maintained at from 50.25 to 50.4° C. thereafter. Other tests showed similar long delays in heating the water at the centre of sacks.

An attempt was made to simulate wire mesh baskets by punching as many holes of one inch and one and a half inch diameter in the sacks as could be managed. This was carried to the extent that breakage of sacks would

have eventuated in practice; plants protruded through holes over most of the sack surface. In the same test as that described above in which two sacks without holes took 25 and 100 minutes to reach 50° C., sacks so punctured required 25 and 45 minutes to reach that temperature. In another test with pierced sacks, immersion was made at 52° C.; this fell to 50.3° C. at seven minutes, and fluctuated between 50.3 and 50.5° C. until the 45 minute period when it dropped to 50° C. until 55 minutes, and rose to 50.3° C. for the rest of the treatment. With water to cane ratio of 5.6 to 1, and circulation cycle nine minutes, two punctured sacks reached 50° C. at 30 and 35 minutes. It was not considered that the puncturing of sacks, even with the maximum possible of cleanly punched holes, met with the requirements of water circulation around the plants.

Tests were carried out with cane in wire mesh baskets of three types. One type measuring three feet in height with a basal area 18in. by 21in. held up to 200 lb. of cane. These tall baskets have a particular application where the individual containers are raised from the water with a lifting device of limited capacity. A second type measured three feet in length by 18in. wide and 18in. in height. These were loaded two deep on a lifting platform, and each held up to 200 lb. of cane. A third type was less than half that size, held approximately 80 lb. of cane and was loaded two deep on a loading platform. Regardless of size, baskets reached an internal temperature of 50° C. in one to seven minutes. A number of such tests were made, and the tank temperature control was similar to that described in the sack tests. There were variations between individual baskets ranging between the limits stated, and in one test a basket which reached 49.85° C. at three minutes fell slightly and rose to 50° C. at ten minutes because of a too sudden drop in the tank temperature in the first five minutes.

At some tanks the delay in heating up the water at the centre of the sacks was counteracted by raising and lowering them to accelerate the exchange of warm and chilled water, and by adding to the two-hour treatment period the length of time taken to reach the desired temperature. At one tank plant, cane was received in very loosely packed sacks, the bottom corners of which were then cut off to provide a three to four inch exit for drainage. The platform supporting the sacks in the tank was raised until the bottoms of the sacks were level with the top of the tank water, and then quickly lowered, once on each occasion. This was done one minute after immersion and at three-minute intervals until a thermometer inserted in a sack registered 50° C. The process was continued at five minute intervals till the end of the first hour and at ten minute intervals during the remainder of treatment. The water-to-cane ratio during tests made was about 7 to 1 and the 1,100 gallons of water in the tank was circulated by a pump every 34 minutes. In four separate batch tests the required internal temperature was reached in 10, 12, 13 and 22 minutes. In each batch there were individual bags that reached 50° C. in less than the periods stated, and the attainment of 50° C. in 10 or 12 minutes was accomplished rather suddenly by an elevation of the tank temperature to 51° C. about that time after it had dropped from the initial immersion reading of 52° C. to 50° C. at the sixth minute. The 13-minute heating period was attained by immersion at 53° C., the temperature being allowed to fall steadily to 50.8° C. at the eleventh minute. During the heating-up period in these tests temperatures were read just before and again after the raising and lowering. As was expected, the hot water inducted into the sack when it was lowered cooled off fairly rapidly while the sack was at rest, the amount of cooling diminishing as equilibrium was approached. It was important therefore to assess the extra time which had to be added to the two hours by reading the thermometer

in the sack when the water was at its lowest temperature, *i.e.*, just before raising.

At another treatment plant the platform bearing sacks of plants was raised and lowered ten times in rapid succession one minute after immersion, but only to the extent that the tops of the bags appeared at the surface of the water. This agitation was repeated with diminishing frequency at intervals of two to three minutes until it was considered that the interior temperatures had reached 50° C., and at longer intervals thereafter. The period that was added to the two hour treatment was assessed by the behaviour of an electrically operated thermostatic control which cut out banks of electric heaters as the heat absorption diminished and the tank approached equilibrium. At the time of the tests the water-to-cane ratio was 8.5 to 1; the circulation cycle 17 minutes. Sacks containing about 90 lb. of cane were immersed at 51.75° C. and reached 50° C. internally in 21, 24 and 34 minutes in individual sacks in the same batch.

The close attention given to tank temperatures relative to internal temperatures revealed several aspects of tank control not hitherto realised. Normally, the operator allowed the immersion temperature of 52° C. to fall quite rapidly to 50° C. since that was the specified treatment temperature. But it was soon discovered that the initial drop in the internal sack temperature prolonged the time taken to reach 50° C. much more than would have been expected. During the first ten to fifteen minutes the cane is absorbing heat rather rapidly. The water between the plants, even in baskets, cannot be regarded as a freely circulating continuum with the tank water. In order to maintain the rise in temperature of the water amongst the plants it is necessary to keep the tank temperature measurably higher than the desired temperature for the first ten minutes. It is sufficient if an immersion temperature of 52° C. is allowed to fall to 51° C. at the fifth minute and to 50.5° C. at the tenth minute. Baskets which had reached 50° and 50.2° C. in one minute fell to 49.85 and 49.9° C. at the fifth and seventh minutes because the tank temperature dropped to 50.2° C. at the seventh minute. During the period of attaining equilibrium the relationship between the tank water, entrapped water and cane plants is highly dynamic. The cane is absorbing heat and the water between the plants is not reheated or replaced sufficiently rapidly if the tank temperature approaches too closely to its own. This was true even when highly turbulent circulation was in operation at rates estimated at 9,000 and 10,000 gallons per hour, a circulation cycle of nine minutes, or less.

A further observation made was hard to accept at face value, but a careful examination of all the conditions surrounding the tests, and its frequency of occurrence have impressed its validity on the writer, and it is of fundamental importance if all the plants are to be treated at 50° C. The water within the containers did not reach the temperature of the free tank water at any time during the treatment but maintained a parallel course about 0.3° C. below. The implication is that to treat cane at 50° C. it is essential to maintain the tank water at not less than 50.3° C., and in very well controlled batches a mean tank temperature of 50.5° C. was indicated as being necessary. The writer suggests that this requirement should be observed at least until some factor is discovered which may have been unwittingly introduced into the tests carried out.

The thermometers used in the tests were found to have individual errors ranging from zero to plus 0.3° C. Operators should carefully check the accuracy of their thermometers at frequent intervals and guard against looseness between the glass stem and metal frame of the long-stemmed brass thermometers used in this work. Looseness will introduce irregular error since the scale is not an integral part of the glass stem. It was found that the cord

wrapping between the glass stem and brass case became loose and gathered round the mercury bulb. It is advisable to keep a replacement glass stem ready for long stemmed thermometers as breakages easily occur. It was found that the thermometers were readable to 0.1° C., and from the experience gained in test runs operators were able to adjust tank temperatures to almost that degree of accuracy. A thermometer readable to only .25° C. does not allow an operator to discover the potentialities of his equipment for accurate control. He is obliged to ask the oft heard question as to what degree of latitude is allowed in the specification of 50° C. as the treatment temperature. The writer's impression, in view of the variations observed between individual containers, is that there is no permissible latitude whatever below 50° C. at control observation points. The latitude inevitable in the treatment must be all upwards. Since consistently higher temperatures prejudice germination accurate control becomes of economic as well as technical importance. Money spent in increasing the accuracy of operation will be saved at the tank in the reduction of further treatments to supply badly germinated blocks of cane, and in the field in the reduction or elimination of supplying and/or in greater yields.

Steam Pressures.—Steam pressure at sugar mills fluctuates very considerably. The writer has experienced a range of 50 to 180 p.s.i.g. in live steam during one two-hour treatment. Observations indicate that thermostatic valves in the steam line to the tank can give excellent control but fail to do so when the pressure drops considerably, because the units in use are designed for a specific range of pressures. It is suggested that investigation is needed into the proposal that thermostat valves should be selected for and calibrated at a range of pressures lower than 100 p.s.i.g., and that a pressure control valve be inserted in the steam pipe to control the pressure to the desired range when the mill boilers are at high pressure. Such units are used in sugar mills but are not commonly available in the small sizes required for the average treatment tank. A full-pressure steam pipe should by-pass this as well as the thermostat for fast heating.

Preliminary tests were carried out with relatively poor water circulation, giving operational cycles of 25 to 35 minutes. Improvements in circulation occurred simultaneously with other factors so that the effect of circulation could not be estimated. Reference has been made, however, to the need for preventing too rapid a drop in the initial immersion temperature. This requires a considerable admission of steam and good circulation by means of a pump is considered necessary to prevent local inequalities of heat in the tank.

Summary.

Hot-water treatment for the eradication of ratoon stunting disease requires that the correct temperature of 50° C. should be maintained in the water in contact with the plants for the entire period of two hours.

The use of sacks as containers for cane plants resulted in considerable delay in reaching the required temperature in the water in the centres of the sacks. The delay varied from 25 to 100 minutes in individual sacks and was not satisfactorily reduced by punching numerous holes in the sacks.

Iron baskets covered with wire mesh permitted the proper temperature to be reached at the centre of the mass of plants in one to seven minutes.

At some centres the delay in reaching the required temperature was reduced by raising and lowering the sacks in the water. This resulted in a lag of 10 to 22 minutes with one procedure and 21 to 34 minutes with another. The time taken for the centres of the containers to reach 50° C. was added to the two-hour period of treatment.

In order to provide a reserve of heat for absorption by the cane after immersion, the tank water was initially

heated to 52° C.; even so it was found necessary to prevent too rapid a fall in temperature during the first ten minutes when heat is being rapidly absorbed. Under the conditions of the tests containers were maintained at 50° C. only if the tank temperature were kept 0.3 to 0.5° C. above, and it is recommended that this precaution should be observed.

It is recommended that thermometers with large calibrations should be used which can be read easily to 0.1° C., and that the water in the tank should be circulated mechanically.

FREE SERVICES TO CANE GROWERS

The Bureau offers the following free services to *all* cane growers in Queensland:—

Soil Analysis and Fertilizer Recommendations

Your soil will be analysed by the most modern methods, and a report will be posted containing a recommendation covering the type of fertilizer required, the amount per acre, the need for lime, and other relevant information. Phone the nearest Bureau office and the soil samples will be taken as soon as possible.

Culture for Green Manure Seed

The Bureau laboratories in Brisbane will post to any cane grower sufficient fresh culture to inoculate seed of cowpeas, velvet beans, mung beans or other types being grown. Instructions for use of the culture will be enclosed. Address your request to The Director, Bureau of Sugar Experiment Stations, Brisbane, *but allow at least a week, after receipt of your letter, for the culture to be prepared and posted.*

Advice on All Phases of Cane Growing

The Bureau staff is at the service of all cane growers. They can best advise you on matters pertaining to varieties, fertilizers, diseases, pests, drainage and cultural methods. Bureau officers are available in every major cane growing district. A phone call will ensure a visit to your farm.